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ABSTRACT

This study measured the effects of specified variables on student knowledge of economics before taking an economics course and the effects of an enlarged set of variables on knowledge gained from taking the course. The pretest included 5,300 students from 200 classes in 150 randomly selected Indiana schools. Missing data and missing students reduced the number of subjects in some of the pre-post comparisons to about 2,200 students. In view of the short available testing time in classes, cognitive tests of only 22 to 24 items were developed and field-tested, following the content of the "Master Curriculum Guide" developed by the Joint Council on Economic Education. Reliability measures of the tests were low, due to the small numbers of test items, but were considered to be satisfactory. Variables that were positive and statistically significant in their effect on economic knowledge before the course was taken included IQ/aptitude percentile, sex, school enrollment, and assessed valuation per student. A school-wide measure of poverty was negatively and significantly related. In the post-test, the pre-test score and most of the same variables were significant, with the expected signs. The characteristic variable indicating participation in the Developmental Economic Education Program (DEEP) showed puzzling relationships in both the pretest and posttest, possibly due to colinearity and to the method of selection of DEEP schools. The paper ends with a short discussion of the problem of using individual student variables with aggregative school-district variables. (IM)

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Student, Teacher and School System Variables Affecting Economic Understanding At the Pre-College Level: Results from the Indiana Council for Economic Education's Statewide Assessment*

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July 1984

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I. Introduction

This paper is presented in two parts. Part I uses conventional models and statistical techniques to estimate student understanding and learning of economics in a pre/post-test framework. The unique aspects of this section of the paper are: 1) use of a large, randomly selected group of schools; 2) introduction of some variables that have not been used in published research on economic education; and 3) use of a more comprehensive set of variables than has been possible in many earlier studies. Particular attention is paid to the recent discussion on the Developmental Economic Education Program (DEEP), and the relationship between DEEP and other variables used in this study.

Part II of the paper offers a brief and preliminary look at a potentially serious problem for research in economic education — namely the need, discussed by Eric Hanushek (1979), to establish whether the use of system-wide variables in educational production function equations specified on an individual student basis leads to biased estimations.

While many of the student, teacher and school system variables reported in Part I of the paper have expected signs and statistically significant coefficients, the DEEP variables were usually negative and often significant explanators of student pre-test scores. In equations using post-test scores while controlling for pre-test results, coefficients on the binary DEEP variable were positive in two of four grades, but only once significant. The most likely reason for these results, compared to earlier studies which reported positive findings on a binary DEEP variable studied across a large number of school systems, appears to be a systematic relationship between the DEEP and other school system variables which were not included in earlier papers. Without controlling for such interrelationships, large-scale, cross-sectional evaluations of the DEEP program are likely to be incomplete and misleading.

In Part II of the paper, the empirical evidence tentatively suggests that aggregation bias is a potentially important issue in economic education research.

Surprisingly, the student sex variable seems to be most affected in this particular set of data. More studies, carefully designed to address this issue, are needed in economic education and general education research.

Part I.

A. The Indiana Council for Economic Education's (ICEE) Statewide Assessment

This section reports results from a statewide testing program conducted in over 150 schools across Indiana during the 1982-83 school year.[1] Schools were chosen at random, stratified only by enrollment size to protect against overrepresentation of small schools. Public and private schools were included in the testing program, but no private school results are reported here due to unavailability of "school system" data for these schools that would allow meaningful comparisons with the public schools. Classes tested in the schools were selected at random in four grade levels -- 5, 8, 11 and 12 -- where key social studies courses are required of all students. History courses are required in grades 5, 8 and 11; a required government class is taught in grade 12. Data from this study and from the Indiana Department of Public Instruction (DPI) indicate that about 55 percent of all grade 12 students in the state take a one-semester course in economics, primarily because many school districts have adopted their own requirement for the course.

Over 200 classes and more than 5,300 students were pre-tested. Given drop-outs, early graduation and re-scheduling of classes between the first and second semester in secondary grades, the total number of students post-tested fell to just over 4,300 students. Research assistants provided by the ICEE administered all tests and collected background information on the students who were pre-tested and their teachers. Background data on school systems was collected by the author from DPI and other agencies -- most notably the Indiana Farm Bureau, Inc. — which regularly publish information on Indiana schools and school districts.

Complete observations were available in equations using pre-test scores as the dependent variable for more than 3,100 students. This drop from the 5,300 figure mentioned above reflects the exclusion of private school students, and to a lesser degree lack of IQ/aptitude data on students, as discussed below. Equations requiring pre- and post-test scores for each observation are reported with a total sample of over 2,200 students. Most of the drop in size from pre-test to post-test sample reflects lack of post-test scores, particularly for students in grades 11 and 12 due to section re-assignments between the first and second semester, drop outs and, in grade 12, early graduation.

The last major point to be made in this section concerns the tests used in the study. In the 1982-83 school year many school systems in Indiana, including several of the largest, used class periods as short as 35-45 minutes, which made it impossible to use nationally normed tests in the Assessment. Three cognitive tests of 22-24 items were developed and field tested (the same test was used in grades 11 and 12).[2] Content areas were selected following the JCEE's Master Curriculum Guide, and in some cases it was possible to use test items from the nationally normed tests. The tests were revised once, based on field testing with a total sample of over 1,000 students from around the state.

Some summary statistics on the revised tests, based on the sample of students who completed the post-tests in the Assessment, are reprinted in the Appendix. KR-20/Cronbach alpha scores on internal homogeneity/reliability are .68, .66, .60 and .64 for grades 5, 8, 11 and 12, respectively. As shown in the Appendix, the primary reason for the drop in values compared to the respective national tests is, as expected, the reduction in the number of test items. In separate testing of 545 students ($n \geq 159$ on each test), correlation coefficients were established for students who took both the national and "Indiana" tests at .564 for students in grade 5, .795 for students in grade 8, and .626 for eleventh and twelfth-grade students. While there is certainly no room, or intent, to claim that the Indiana tests should replace the national tests, they do perform reasonably well

considering the limited number of questions that could be used, the range of topics and concepts covered on the tests, and the near random heterogeneity of the students taking the test, which may not have existed on all of the national tests — on this and other points on the national tests see Walstad and Buckles (1983). More extensive information on the Indiana instruments is available upon request.

B. The Evaluation Model

Two basic equations are estimated for each grade level -- the first looks at individual students' "stock" of economic understanding at the start of the school year; the second examines end-of-year understanding controlling for pre-test scores, so that other variables test factors contributing to the "flow" of student learning during the year. A simple outputs as a function of inputs model is used, which can be generally summarized following the "taxonomy" procedure described by Davisson and Bonello (1976), and is often used in some general form by researchers investigating pre-college economic education.[3]

The pre-test model is, then:

1) $U = f(I, S)$

where U = student understanding, I = key student inputs/qualities such as IQ/aptitude scores and sex, and S = a vector of school system variables which influence the student over a period of years in the school system (e.g., the size of the district). Some school system variables reflect a wide range of socioeconomic characteristics of residents of the district, of course, and it was accepted that they would do so in this study.

The post-test model is:

2) $L = f(I, S, T)$

where L = student learning during the school year, measured by test scores; I = an expanded (compared to the pre-test model) vector of individual inputs including, for grade 12, recognizing which students took a one-semester course in economics; S = school system variables, as in the pre-test model, and; T = teacher

characteristics, such as years of full-time teaching experience. The only teacher data used was for teachers of the social studies course the student took during the 1982-83 school year, so this information was entered only in the post-test model.

The specific variables used in estimating these general relationships are, in addition to scores on the tests described earlier:

IQ/Aptitude Percentile — perhaps the most important socioeconomic characteristic a school district "inherits" from its student and family clientel is performance on IQ and aptitude tests. This variable is assumed to be positively and significantly related to students' test scores, in line with results from many earlier studies. Since all of the school systems did not use the same test measures on this variable (many apparently use none at all, particularly at the high school level), the average of any percentile scores on IQ or aptitude measures was entered, excluding only scores for college board exams (e.g., the SAT, ACT, or PSAT exams) where rankings typically refer to college-bound students. Percentiles were taken as available from student records, except on IQ scores were it is a relatively easy to estimate a percentile measure from a score (see, for example, Cronbach, 1970) if none is reported on the records.[4]

Student Sex — many studies have found that males typically score higher on multiple choice economics tests than females. The most frequently cited study on this variable in economic education research is perhaps MacDowell, Senn and Soper (1977); more recent work has been reported by Siegfried (1979) and Ferber, Birnbaum and Green (1983). The issue is quite possibly related to the emerging literature on sex-related differences in spatial and numerical abilities. No attempt is made here to investigate reasons for differences in performance levels, but given earlier studies the variable was included as an important control. There is a strong hypothesis that the variable (coded Male = 1, Female = 0) will be positive and significant on the pre-test equations -- a weaker hypothesis in the same direction for results on the post-test/learning equations.

Economics Course — over half of the grade 12 students in Indiana take a one-semester course in economics in either the first or second semester of the school year. A binary variable (1 indicating that the student responded at the time of the post-test that he or she had taken a course in economics, 0 = not) was entered for the grade 12 post-test equation. It is predicted that the coefficient on this variable will be positive and significant.[5] Little previous research has been published on this variable, although some studies have concluded that a high school economics course will not substantially affect performance in principles of economics course at the university level (see Saunders, 1970; Palmer et. al., 1979; and Moyer and Paden, 1968).

School System Enrollment — while the expected effects of this variable may not be clear in many subject areas, the hypothesis here is that large systems encourage greater teacher and support service specialization, which will be especially important at the secondary level. Earlier studies have reported such a positive relationship (Walstad and Soper, 1982 and Strom, 1979), and it has been argued that there are important economies of scale at work in high schools (Riew, 1966). The variable is entered in log form here, as usual, to smooth the skewed enrollment pattern of systems for the sample.

Assessed Valuation Per Student — this variable captures information on a school system's budget constraint (which may be modified by other variables such as state or federal appropriations per student) and the wealth of families living in the district (though this, too, can be misleading if there are many business properties in an otherwise poor district). This variable is more standard across Indiana districts than such measures as instructional expenditures per student, given inter-district differences in procedures for calculating the expenditures measure. It is assumed that valuation will be positively correlated with student test measures; the variable was also used by Strom (1979).

Poverty Index — this variable measures the percentage of students in the district receiving federally-paid "free lunches." It is thus a kind of poverty

index for each district, when used in conjunction with the assessed valuation per student variable described above. The assumption is the variable will be negatively correlated with student test scores. In economic education research, this variable was first used by Soper and Brenneke (1983).

DEEP — school systems may participate in the DEEP program by having the superintendent sign a 1-page form agreeing to make economic education in grades K-12 a priority curriculum area, and by designating someone in the system as the DEEP Coordinator.[6] Earlier studies have suggested or shown a binary DEEP variable (1 = DEEP) to be positively and significantly correlated with student test results (Becker, et.al., 1975), (Soper and Brenneke, 1981), (Walstad and Soper, 1982), (Buckles and Freeman, 1984), but the relationship is not simple. Soper and Brenneke raise the possibility of "paper" DEEP systems, based on observations of lower test scores for students in DEEP systems who had not had formal instruction in economics (p. 12). They also discuss the troublesome effects of including "new" DEEP schools in an evaluation project, where there has been little time to implement curriculum change. In this study, a number of systems had recently joined DEEP, but more importantly it was also possible to control for other system variables and teacher training in economics in ways earlier studies did not. Since a key component of DEEP program is typically teacher training, the effect of adjusting for training is likely to make the coefficient on the DEEP variable smaller and less significant. Therefore, only a weak hypothesis is put forward that the DEEP variable will be positive and significant.

Years From Teacher's Last Intensive Coursework in Economics — earlier studies (Walstad and Soper, 1982; Highsmith, 1974; and Walstad, 1979 and 1980) have found that students of teachers who have completed at least one intensive course in economics score significantly higher on standardized tests. In the sample of over 200 teachers included in this study, however, few teachers had not completed at least one intensive course. A binary code thus seemed inappropriate, and given this level of training among teachers the opportunity to explore the

effect of years from last training was present. This variable was entered as a positive integer -- in the few cases where a teacher had no intensive coursework (defined as a three semester hour or longer credit course) the value was calculated as years from the sophomore, undergraduate year of training, in which many education majors are required to take an economics course. The hypothesis is that this variable will be negatively and significantly correlated with student test scores. In this form, the variable is consistent with the idea of teachers' human capital as an input in the learning process, but one subject to decay. The "lasting effects" literature in economic education has explored this topic most directly. See Saunders (1980) and Kohen and Kipps (1979).

Experience — teachers' years of full-time experience was included as a human capital variable, and to examine the trade-off between the hypothesized positive gain in student scores from this variable and the negative effect of adding another year to the "Years From Economics" variable, <u>except</u> in cases where an experienced teacher periodically takes "refresher" courses.

Minutes of Economics Taught — little information is available on how much classroom time teachers devote to economics instruction outside the regular economics courses. What evidence there is suggests that this time is very limited (Walstad and Watts, 1984). Teachers in this study were asked to estimate, at the beginning of the school year, the average number of minutes they would devote to economic instruction each week with the class being tested. This value was entered into the post-test equations for grades 5, 8 and 11, with the hypothesis that higher minutes would result in positive impacts on student scores. The value was <u>not</u> entered in grade 12, given the high correlation with the variable indicating which students had taken a formal course in economics. Even in other grades, since the minutes variable is survey data, the hypothesis is very weak. All teachers faced some incentives to respond with high estimates, and on the other hand teachers with little or no formal training in economics might have planned to teach more economics (of uncertain quality, to be sure) than they knew. This

measure, and similar kinds of teacher survey information, is of uncertain value, and at the same time often intriguing and potentially important.

C. Empirical Results

Tables 1 and 3 show the estimated coefficients of the variables discussed above. Table 1 reports the pre-test "stock" equation, shown for all four grades. Table 3 shows the post-test or "learning flow" equation. Means and standard deviations for the variables in all equations are shown in Tables 2 and 4.

-- Tables 1 and 2 About Here --

Looking first at the pre-test equation, there are no real surprises with the student variables. The IQ/aptitude scores are significant in all grades, as is the sex variable. Among the school system variables, the three positive (two of them significant) coefficients on the enrollment variable are observed at the secondary level, which is consistent with the specialization and "economies of scale" hypothesis. The valuation variable is always positive but significant only in the three secondary grades, suggesting a kind of long-term, cumulative effect for this input. The poverty index is always negative, and significantly so except for grade 8. That probably reflects a "quirk" in the grade 8 data, since by chance none of the large, urban school districts in the state were drawn in this sample. The DEEP variable has a negative sign in three cases — twice with statistically significant coefficients. The literal message here seems to be that DEEP systems begin the year with weaker students in terms of economic understanding (and perhaps other characteristics, as discussed later). That may help explain why the system joined the DEEP program in the first place. But this is a potentially complex variable, and it is important to recognize that there is a consistently positive and fairly strong correlation between the DEEP and enrollment variables, and also between the DEEP and Poverty variables in three grades. Simple correlation coefficients between DEEP and the other independent variables are shown, in brackets, in Tables 2 and 4. Also, the insignificant

coefficient for the valuation variable in the grade 5 equation probably reflects a high correlation with the DEEP variable in that grade.

There is, in fact, a bimodal pattern of DEEP membership by school systems in Indiana, that may be characteristic of other states as well. DEEP systems in Indiana tend to be either large urban districts with many students exhibiting low IQ/aptitude scores and from low-income families, or larger than average surburban districts in which student IQ/aptitude scores are relatively high but in which systems still have many students from low-income families, probably due to their proximity to urban areas. This second sort of system is seen most clearly in the grade 8 equation -- but note there that even with higher average IQ's than the total sample, a slightly positive correlation between DEEP status and the IQ/aptitude variable, and a much weaker correlation between the DEEP and enrollment variables, the correlation between DEEP and pre-test scores is still negative. This reinforces the straightforward interpretation of the DEEP variables in these equations, namely that DEEP schools start the school year with relatively weaker students in terms of economic understanding. With that tentative idea, then, Table 3 can be reviewed to see how information there supports, extends or refutes this proposition.

-- Tables 3 and 4 About Here --

Student IQ/aptitude scores are significant and positive inputs into student learning at all four grade levels, which is hardly surprising. Male students in grade 5 learned significantly more economics than females, but not so in any of the secondary grades. In grade 12, the one-semester economics course variable was, as expected, positive and significant.

Turning to the school system variables, only valuation per student is significant in at least two equations -- both times with the expected positive impact. The DEEP coefficients are positive in grades 5 and 8 (significantly so in grade 8), negative but not significant in 11 and 12. The poverty variable is always negative, but significant only in grade 11. Enrollment is positive and

insignificant in all grades but 8, where it is negative and nearly significant (perhaps reflecting differences between the systems in grade 8 and other grades, discussed above). It is still difficult to sort out the collinearity effects between the DEEP, poverty and enrollment variables — in fact more so, because the economics course variable in the grade 12 equation probably "swamps" other kinds of system impacts, and because inclusion of the teacher training variables is also expected to affect the estimates for DEEP, as discussed earlier.

Reviewing the teacher inputs before considering the DEEP issue in more detail, minutes taught is always positive but insignificant. The experience and years from last economics course variables are, respectively, positive and negative in all grades but 12. Again, these variables may be masked in the grade 12 equation because of the impact of the economics course variable. Also, even though the teachers in grade 12 are, on average, three or four years more experienced than teachers in the other grades, they are closer to their last intensive coursework by, on average, about a year. This reflects the fact that the economics teachers are more likely to have more total hours in economics and to return for updated in-service training or coursework. In the other grades, there is evidence of the trade-off between experience and years from training in economics, particularly in grade 8 where both variables are significant.

It happens that the DEEP variable is not strongly tied to the teacher variables in any way that would systematically lessen the impact of the coefficient in a theoretical sense. For example, if the years from last course in economics variable was negatively correlated with the DEEP binary, we could say that what that teacher variable picked up in explanatory power represented part of the DEEP process. However, the DEEP teachers were, on average, further away from their last training in economics, and in two grades more likely to plan to teach fewer minutes per week on economics. Students in DEEP systems were also less likely to take the one-semester course in economics. In spite of the data on the "years from" variable noted above, a higher percentage of teachers in DEEP systems

than in non-DEEP systems had taken a separate, intensive workshop in economics and had completed more total hours of economics coursework. If they had not, the "years from" disparity would be even stronger.

To conclude this discussion of DEEP and Part I of the paper, while the DEEP binary is not generally positive and significant here, as it has been in earlier studies, that probably occurs because other variables included here were not included in the earlier reports. Studies that do not control for key school system variables and, to a lesser degree, teacher training in economics, are more likely to report significant findings using the dummy variable. It must be recognized that certain kinds of school systems are most likely to participate in DEEP, than others, and the characteristics of those systems may have more to do with the supposed effects of DEEP — when measured by a binary — than the DEEP program itself.

Part II.

The Potential for Aggregation Bias

In this section, some tentative explorations into a problem raised by Eric Hanushek (1979) are noted. In a review article on issues in the estimation of educational production functions Hanushek wrote:

> The researcher frequently has individual data about students (say, achievement and family background), but only aggregate data about schools. The temptation is to use all available data by mixing individual characteristics with aggregate school data. However, the school factors relevant to any individual may differ significantly from the average. Here, aggregation generally helps; the errors in measurement for a model of average achievement and average characteristics are almost certainly less than with individual achievement and average school characteristics (p. 123).

It is obvious that, in Part I of this paper, this "sin" was committed; just as obviously, so have many earlier studies cited here, and quite probably so may many more published in the future. Still, it is important for economic education researchers to begin addressing this point, and the data set developed for this study allows some preliminary steps in that direction since many different school

systems are included. The expense of data collection across large numbers of schools or school systems is extremely high, if a reasonably large sample size is to be maintained. This undoubtedly explains why few such studies are done.

Even with the sample sizes in this study, maintaining a large sample using aggregated data is impossible unless data from all grade levels are pooled. This was done by converting pre- and post-test scores into percentages, taking averages of data for all schools from a particular school district, and controlling for grade level differences by adding three dummy variables for grades 8, 11 and 12. This begs the question of measurement error on the different tests coming from different distributions -- but this is intended as an exploratory look at data, not classical hypothesis testing.

Individual observation data was also estimated, pooled across grades, as a basis for comparison to the aggregated data. The individual observation equations using the general models developed in Part I are presented in Table 5.

-- Tables 5 and 6 Ahout Here --

Note that t-statistics are <u>not</u> shown (standard errors are); however, virtually all of the variables would be significant with expected signs if hypothesis testing was justified. The grade-level variables show the older students beginning the year with a higher stock of economic knowledge, but adding less to that stock than younger students during a school year. Comparing the equations to the aggregated data versions in Table 6, note first that R^2's increase in the latter equations since there is less volatile variation to explain.

The <u>major</u> difference observed in sign or potential significance is, interestingly, in the sex variable. The variable would not be significant in the aggregated version, but does exhibit a <u>negative</u> sign. While this estimation certainly does not support much speculation, it is tempting to consider whether the percentage of females in a school system (which is what is now measured)

somehow contributes to system-wide achievement in economics through the mechanism of improving individual male students' scores.

Some of the variables would vary in significance across the two forms of one or both equations. In only one case apart from sex, however, (the grade 8 dummy in the pre-test equation) does a sign change. Except for sex, the message of the two forms of the questions is broadly consistent (signs agree in 22 of 25 instances, signs and acceptance or rejection of significance — if hypothesis testing were to be used -- in 14 cases). Still, Hanushek's concern is obviously valid in the field of economic education from a conceptical standpoint and from this preliminary bit of empirical evidence.

If it can be established with additional studies which variables are or are not affected by aggregation basis, and perhaps even that these "all grade, pooled-data" equations can be usefully and appropriately employed under certain circumstances, the benefits for economic education research may be substantial.

TABLE 1: Pre-test Scores As Dependent Variable
(t Statistics in Parentheses)

	Independent Variables	Grade Level 5	8	11	12
STUDENT VARIABLES	IQ/Aptitude Percentile	.081 (20.182)**	.079 (18.527)**	.056 (14.794)**	.067 (15.643)**
	Sex	.545 (3.073)**	.617 (2.989)**	.588 (3.011)**	.521 (2.482)**
SCHOOL SYSTEM VARIABLES	LOG N Enrollment	-.048 (.432)	.312 (2.422)**	.016 (.104)	.324 (2.189)**
	Assessed Valuation Per Student	.0000098 (.930)	.000042 (2.110)**	.000021 (2.036)**	.000037 (2.614)**
	Poverty Index	-3.117 (3.230)**	-2.118 (1.309)	-2.717 (1.746)*	-5.595 (3.243)**
	DEEP	-.040 (.139)	-.508 (2.432)**	.150 (.495)	-.773 (2.505)**
	Constant	5.537 (5.729)**	1.255 (1.099)	6.662 (5.155)**	4.717 (3.853)**
	F	83.759	68.916	45.126	51.623
	P	.000	.000	.000	.000
	Adj R^2	.333	.361	.269	.295
	N	994	721	721	728

* = significant at .05 level (one-tailed test)

** = significant at .01 level (one-tailed test)

TABLE 2: Means and (Standard Deviations) of Variables -- Equation 1 [Correlation Coefficients Between DEEP and Other Variables are shown in brackets.]

	Independent Variables	Grade Level 5	8	11	12
STUDENT VARIABLES	Pre Score	9.496 (3.408) [-.102]	9.234 (3.437) [-.061]	10.111 (3.042) [-.015]	11.067 (3.360) [-.118]
	IQ/Aptitude Percentile	54.883 (22.863) [-.067]	57.574 (24.804) [.004]	51.194 (26.621) [-.005]	53.586 (25.195) [.012]
	Sex	.479 (.500) [-.051]	.526 (.500) [.027]	.558 (.497) [.012]	.523 (.500) [.034]
SCHOOL SYSTEM VARIABLES	LOG N Enrollment	8.500 (1.157) [.689]	8.582 (.887) [.167]	8.829 (1.165) [.746]	8.846 (1.119) [.660]
	Assessed Valuation Per Student	25.451 (10.149) [.469]	23.171 (5.346) [-.025]	23.381 (9.811) [.098]	22.615 (7.730) [.172]
	Poverty Index	.177 (.123) [.517]	.151 (.073) [.079]	.170 (.098) [.568]	.163 (.096) [.638]
	DEEP	.302 (.500) ---	.441 (.497) ---	.408 (.492) ---	.357 (.480) ---
	N	994	721	721	728

TABLE 3: Post-test Scores As Dependent Variable
(t Statistics in Parentheses)

Independent Variables		Grade Level 5	8	11	12
STUDENT VARIABLES	Pre Score	.477 (13.606)**	.382 (10.194)**	.424 (7.654)**	.387 (6.465)**
	IQ/Aptitude Percentile	.060 (11.686)**	.063 (11.820)**	.030 (4.302)**	.048 (6.194)**
	Sex	.372 (1.927)*	-.023 (.109)	.351 (1.058)	.032 (.096)
	ECON	--- ---	--- ---	--- ---	1.163 (3.317)**
SCHOOL SYSTEM VARIABLES	LOG N Enrollment	.166 (1.279)	-.252 (1.626)	.455 (1.395)	.237 (.913)
	Assessed Valuation Per Student	.000035 (2.949)**	-.000017 (.770)	.000031 (2.018)**	.000017 (.576)
	Poverty Index	-.599 (.561)	-.796 (.430)	-7.091 (2.587)**	-2.053 (.657)
	DEEP	.315 (.914)	.638 (2.746)**	-.127 (.205)	-.058 (.113)
TEACHER VARIABLES	Years From Last Econ Course	-.013 (.654)	-.108 (5.873)**	-.022 (1.068)	.026 (1.310)
	Minutes of Economics Taught	.0037 (1.012)	.00086 (.147)	.0051 (.602)	--- ---
	Experience	.028 (1.208)	.112 (5.683)**	.052 (1.343)	-.014 (.590)
	Constant	2.324 (2.055)**	5.693 (4.504)**	.916 (.382)	2.161 (1.073)
	F	78.925	69.439	19.539	19.274
	p	.000	.000	.000	.000
	Adj R^2	.472	.525	.322	.337
	N	873	620	392	361

* = significant at .05 level (one-tailed test)

** = significant at .01 level (one-tailed test)

TABLE 4: Means and (Standard Deviations) of Variables -- Equation 2 [Correlation Coefficients Between DEEP and Other Variables are shown in brackets.]

	Independent Variables	Grade Level 5	8	11	12
STUDENT VARIABLES	Post Score	11.030 (3.894) [-.059]	10.606 (3.761) [-.042]	11.212 (3.594) [.008]	12.155 (3.790) [-.022]
	Pre Score	9.458 (3.386) [-.099]	9.224 (3.442) [-.088]	10.298 (3.214) [-.044]	11.427 (3.273) [-.074]
	IQ/Aptitude Percentile	54.578 (22.940) [-.101]	57.921 (24.137) [-.041]	56.020 (26.106) [-.022]	57.302 (26.660) [.021]
	Sex	.493 (.500) [-.026]	.529 (.500) [.035]	.559 (.497) [.070]	.532 (.500) [.081]
	ECON	--- ---	--- ---	--- ---	.512 (.500) [-.065]
SCHOOL SYSTEM VARIABLES	LOG N Enrollment	8.415 (1.139) [.700]	8.551 (.896) [.172]	8.829 (1.278) [.858]	8.841 (1.165) [.676]
	Assessed Valuation Per Student	25.364 (10.396) [.477]	23.172 (5.434) [-.032]	23.785 (10.121) [.014]	21.774 (6.242) [.206]
	Poverty Index	.174 (.124) [.500]	.155 (.069) [.147]	.162 (.097) [.643]	.159 (.094) [.675]
	DEEP	.291 (.454) ---	.423 (.494) ---	.485 (.500) ---	.349 (.477) ---
TEACHER VARIABLES	Years From Last Econ Course	14.986 (8.060) [.116]	14.419 (8.646) [.074]	15.056 (8.938) [.147]	13.814 (9.109) [.064]
	Minutes of Economics Taught	17.746 (28.925) [-.118]	20.308 (21.153) [-.064]	24.638 (20.022) [.313]	--- --- ---
	Experience	13.002 (6.942) [.196]	15.052 (7.942) [-.201]	13.707 (5.383) [.341]	17.928 (9.186) [.378]
	N	873	620	392	361

TABLE 5: All Grades -- Individual Observations
(Standard Errors in Parentheses)

Independent Variables \ Dependent Variables		Pre-Test Percent Possible	Post-Test Percent Possible
STUDENT VARIABLES	Pre Score	---	.435
		---	(.022)
	I/Q Aptitude Percentile	.302	.224
		(.0087)	(.013)
	Sex	2.436	.875
		(.420)	(.524)
	ECON	---	3.369
		---	(1.142)
SCHOOL SYSTEM VARIABLES	LOG N Enrollment	.791	.605
		(.270)	(.346)
	Assessed Valuation Per Student	.000098	.0000079
		(.000026)	(.000032)
	Poverty Index	-15.713	-11.589
		(2.771)	(3.442)
	DEEP	-1.906	.646
		(.556)	(.707)
TEACHER VARIABLES	Years From Last Economics Course	---	-.150
		---	(.038)
	Minutes of Economics Taught	---	.0060
		---	(.0057)
	Experience	---	.177
		---	(.046)
GRADE LEVEL	Grade 8	1.418	-.518
		(.589)	(.669)
	Grade 11	3.514	-2.224
		(.587)	(.778)
	Grade 12	6.708	-3.323
		(.587)	(1.035)
	Constant	15.576	12.681
		(2.263)	(2.834)
	F	175.031	124.461
	p	.000	.000
	Adj R^2	.331	.437
	N	3164	2225

TABLE 6: All Grades — Aggregated School System Data
(Standard Errors in Parentheses)

Independent Variables \ Dependent Variables		Pre-Test Percent Possible	Post-Test Percent Possible
STUDENT VARIABLES	Pre Score	---	.556
		---	(.130)
	I/Q Aptitude Percentile	.218	.115
		(.047)	(.552)
	Sex	-2.704	-1.189
		(3.274)	(3.485)
	ECON	---	6.813
		---	(1.911)
SCHOOL SYSTEM VARIABLES	LOG N Enrollment	.700	.618
		(.507)	(.542)
	Assessed Valuation Per Student	.00011	.000071
		(.000045)	(.000048)
	Poverty Index	-17.545	-9.565
		(5.454)	(6.209)
	DEEP	-1.001	1.209
		(1.036)	(1.073)
TEACHER VARIABLES	Years From Last Economics Course	---	-.213
		---	(.072)
	Minutes of Economics Taught	---	.00019
		---	(.0098)
	Experience	---	.077
		---	(.077)
GRADE LEVEL	Grade 8	-.333	-.338
		(1.025)	(1.052)
	Grade 11	.462	-.798
		(2.363)	(2.505)
	Grade 12	7.651	-6.878
		(2.216)	(2.896)
	Constant	23.872	14.678
		(5.404)	(6.655)
	F	10.573	8.877
	p	.000	.000
	Adj R^2	.525	.588
	N	79	79

APPENDIX

TABLE 7: Summary of the Comparison of the ICEE Assessment Test (Cognitive Items) for Grade 5 To The JCEE Basic Economics Test (BET)

	BET-A	BET-B	ICEE-5
Mean	46.7%	47.0%	46.4%
s(% of Mean)	34.8%	31.0%	34.8%
n	4462	4266	1312
SEM(% of Mean)	15.2%	15.2%	19.8%
Cron. Alpha	.81	.76	.68*

* adjusted to the BET number of questions using the Spearman-Brown formula this statistic is .77.

Range and Distribution of Discrimination Coefficients

BET

	Form A	Form B
0-10	7.9%	10.5%
10.01-20	7.9%	15.8%
20.01-30	29.0%	36.8%
30.01-40	36.8%	34.2%
40.01-50	18.4%	2.6%

ICEE Grade 5 Test

0-10	8.3%
10.01-20	4.2%
20.01-30	12.5%
30.01-40	41.7%
40.01-50	33.3%

APPENDIX (Continued)

TABLE 8: Summary of the Comparison of the ICEE Assessment Tests

(Post-Test, Cognitive Items) for Grade 8

To the JCEE Junior High School Test

	JCEE-JH	ICEE-8
Mean	44.2%	47.7%
s(% of Mean)	33.6%	34.5%
n	2936	1220
SEM(% of Mean)	17.2%	20.2%
KR-20	.76	.66*

* adjusted to the JCEE Jr. High Test number of questions using the Spearman-Brown formula the statistic is .78.

Range and Distribution of Discrimination Coefficients

JCEE Jr. High Test

NOT PROVIDED

ICEE Grade 8 Test

0-10	0.0%
10.01-20	0.0%
20.01-30	27.3%
30.01-40	50.0%
40.01-50	22.7%

APPENDIX (Continued)

TABLE 9: Summary of the Comparison of the ICEE Assessment Test (Post-Test, Cognitive Items) for Grades 11 and 12 To the JCEE Test of Economic Literacy (TEL)

	TEL-A	TEL-B	ICEE-11	ICEE-12
Mean	46.9%	49.8%	45.2%	50.7%
s(% of Mean)	39.5%	36.8%	32.0%	30.8%
n	4192	4468	954	833
SEM(% of Mean)	14.0%	13.2%	20.9%	18.5%
Cron. Alpha	.88	.87	.60*	.64*

* adjusted to TEL number of questions using the Spearman-Brown formula, these statistics are .74 and .77 for grades 11 and 12, respectively.

Range and Distribution of Discrimination Coefficients

TEL

	Form A	Form B
0-10	0.0%	0.0%
10.01-20	0.0%	2.2%
20.01-30	15.2%	17.4%
30.01-40	45.7%	34.8%
40.01-50	39.1%	37.0%
50.01-60	0.0%	8.7%

ICEE Grades 11 and 12 Test

	Grade 11	Grade 12
0-10	0.0%	0.0%
10.01-20	0.0%	0.0%
20.01-30	41.7%	37.5%
30.01-40	45.8%	54.2%
40.01-50	12.5%	8.3%
50.01-60	0.0%	0.0%

Notes

[1] The testing and evaluation results presented here represent the third set of information developed on ICEE and/or other statewide Indiana economic education projects. A study evaluating teacher responses to ICEE in-service programs was first released in 1981 (Buckles, Strom and Walstad). Profiles of teacher characteristics and student testing results from the ICEE Statewide Assessment have been described in earlier reports (Watts, 1983).

[2] Other researchers have, of course, found it necessary or desirable to modify published test instruments or develop new instruments to fit the constraints of their evaluation projects. See, for example, Walstad (1980).

[3] Most such reports are published in the Journal of Economic Education. See, for example, Walstad (1979 and 1980); Walstad and Soper (1981 and 1983); Soper and Brenneke (1981); Chizmar and Halinski (1983); and Highsmith (1974).

[4] Alternative specifications on this variable were estimated, including use of only IQ scores taken from student records and use of only the most current percentile score available. Except for changes in the number of observations, the different specifications resulted in virtually no differences in the empirical results.

[5] Obviously there would be some difference in the nature of these classes in different school systems. To keep the response as homogeneous as possible, however, consumer and business education courses were also listed as distinct items (along with more than a dozen other courses). From what is known of textbooks, guidelines and school system requirements for this course in economics, the response does appear to indicate regular coursework on basic principles of economics, at least for most students.

[6] This procedure has been somewhat modified recently, in conjunction with the Joint Council's national DEEP Expansion Project.

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